U. S. FOREST SERVICE
R-6

3400
Portland, Oregon
March 1964

EVALUATION OF WESTERN HEMLOCK LOOPER LARVAL POPULATIONS WITHIN THE 1962 CONTROL PROJECT BOUNDARIES AT CLATSOP COUNTY, OREGON IN AUGUST 1963

by

Paul E. Buffam, Entomologist
Division of Timber Management
Insect and Disease Control Branch

SUMMARY

1. In August 1963, an evaluation was made of western hemlock looper larval populations at 24 points within the boundaries of the 1962 spray project in Clatsop County, Oregon.

2. Some looper larvae were collected at all areas. Larval numbers on most plots sampled in 1963 were equal to or slightly less than those in 1962. Looper populations were moderate to heavy at 15 of the 24 points sampled.

3. Single egg samples collected by present methods do not give reliable estimates of subsequent larval populations. However, data from many samples should reliably indicate the overall extent and severity of an infestation.

4. Looper larval numbers were significantly greater in collections from five understory plants than in collections from five 18-inch branches from overstory hemlock foliage.

5. More early instar larvae were found in the understory than in the overstory, and more late instar larvae in the overstory than the understory.

6. Looper larvae seem to prefer red whortleberry, vine maple, western hemlock, and ovalleaf whortleberry in the understory in that order. Larvae are abundant on stink currant and salal when these two plants are present.

INTRODUCTION

In July 1962, 32,531 acres of western hemlock in Clatsop County, Oregon infested with the western hemlock looper, Lambdina fiscellaria lugubrosa Hulst, were treated with DDT insecticide. This cooperative control project was undertaken by the Oregon State Department of Forestry, private industry, and the U. S. Forest Service. An average looper larval mortality of 88.2 percent was obtained.[1/] This control level was expected to adequately prevent subsequent tree killing. However, during an aerial survey in the fall of 1962, over 1,000 acres of lightly to heavily defoliated timber were detected within the 1962 project area, and some tree killing was present.[2/]

Results of a looper egg survey in March 1963 showed that eggs were abundant at several points within the treated area. No eggs were recovered from samples collected outside of the control boundaries, so no appreciable spread had occurred, and no new outbreaks had developed.[3/] Private and State timber owners decided to salvage dead or dying trees in 1963 rather than attempt control because the infestation was in a concentrated area readily accessible by road. However, the owners recommended that the looper population be sampled in 1963 to determine its significance.

In August 1963, Forest Service biologists sampled old spray project mortality plots and established new sample plots to gain more information on whether the original outbreak was increasing or decreasing. Understory and overstory looper larval populations were sampled, development at each sampling medium determined, and understory host plant preference studied.

1/ Buffam, Paul E. 1963. Summarization report of the technical aspects of the 1962 western hemlock looper control project at Astoria, Oregon. U. S. Forest Serv., Pac. N.W. Region, 19 pp.

2/ Orr, Peter W. 1963. Forest insect conditions in the pacific northwest during 1962. U.S. Forest Serv., Pac. N.W. Region, 47 pp.

3/ Buffam, Paul E. 1963. Results of the 1963 western hemlock looper egg survey in northwest Oregon. U.S. Forest Serv., Pac. N.W. Region, 4pp.

LOOPER POPULATION STUDIES IN 1963

Looper larval populations were sampled from August 5-9, 1963, to help determine the status of the present infestation that became epidemic in 1961. Trees were sampled at 24 different locations. Looper larval mortality was studied in 10 of these areas during the 1962 spray project. The remaining plot locations were selected in areas defoliated in August and September 1962. Moss samples were collected in March 1963 near 11 of the 24 plots.

At each plot, overstory and understory plants were sampled. Overstory looper larval populations were sampled in the lower crowns of five codominant, intermediate, or suppressed western hemlocks on each plot. Five 18-inch twigs were cut from each tree using an aluminum pole pruner. Understory samples consisted of five branches and/or entire plants of several of the most abundant plant species. Each branch or plant was held over a 3-foot-square muslin beating sheet held rigid by a wooden frame. The foliage was tapped or shaken causing looper larvae to drop on the sheet. Larvae from both overstory and understory collections were counted and placed in alcohol-filled vials for instar determination in the laboratory.

Understory plants sampled were:

1. Red whortleberry (red huckleberry), Vaccinium parvifolium
2. Ovalleaf whortleberry (tall blue huckleberry), Vaccinium ovalifolium
3. Vine maple, Acer circinatum
4. Western hemlock (seedlings and saplings), Tsuga heterophylla
5. Stink currant, Ribes bracteosum
6. Salal, Gaultheria shallon
7. Salmonberry, Rubus spectabilis

Only those infestations known or discovered through cursory surveillance were sampled this year. Other small infestations within the 1962 control project boundaries may not have been discovered in 1963 and, therefore, not sampled.

STATUS OF THE PRESENT LOOPER OUTBREAK

Samples from all areas produced some larvae (table 1). No larvae were collected from the overstory sample on Plot 1, but all other collections yielded at least one looper from both understory and overstory sources. Moderate to heavy numbers (20 or more larvae) were taken at 15 of the 24 plots.

Table 1.--Number of hemlock looper larvae collected in August 1963 on 24 plots in Clatsop County, Oregon.

Plot No.	Larvae from 5 beatings of understory foliage	Larvae from 5 18-inch twigs on each of 5 trees	Difference between understory and overstory collections
		Number	
1	2	0	-2
2	1	2	1
3	65	89	24
4	35	54	19
5	9	7	-2
5A	38	14	-24
6	2	1	-1
6A	1	1	0
7	35	25	-10
8	51	37	-14
9	135	167 1/	32
10	34	32	-2
11	11	5	-6
12	4	1	-3
13	108	56	-52
14	58	38	-20
15	85	34	-51
16	3	2	-1
16A	8	1	-7
17	40	14	-26
18	63	36	-27
19	35	20	-15
20	43	33	-10
21	24	3	-21

1/ Seven trees sampled.

A comparison of larval counts indicates that 1963 populations were equal to or slightly less than 1962 populations (table 2). First and second instar larvae were sampled in 1962 and third, fourth, and fifth instars in 1963. Mortality, at least theoretically, occurs during every stage of the looper's life cycle, thus the larval population in 1963 was probably equivalent to the one remaining after treatment in 1962.

Data from eleven plots where both egg and larval populations were sampled in 1963 indicate that results using the present egg sampling methods cannot be used to reliably estimate subsequent larval populations in surrounding trees (table 2). 4/ Larval populations were not proportional to the preceding egg populations. On Plot 5, 39 eggs were recovered in the moss samples collected during the March egg survey, but only 4 larvae were collected in August. On Plot 9A, only 2 eggs were obtained from the moss sample but later, 167 larvae were collected. Data from these two plots show the extremes, but most other comparisons between eggs and the subsequent larvae were inconsistent. However, egg survey data from many sampling points should give a reliable estimate of the overall extent and severity of an outbreak.

Very few looper eggs were collected during the December 1963 survey in northwest Oregon (table 2). 5/ No serious looper-caused defoliation is expected in the summer of 1964. The reason for reduction in egg numbers between the March and December 1963 surveys is not known. However, a polyhedral virus disease known to reduce looper populations in the third or fourth year of an outbreak may have caused sufficient mortality in late August 1963 after larval counts were made.

4/ Ibid.

5/ Buffam, P. E. 1964. Results of the December 1963 western hemlock looper egg survey in northwest Oregon. U. S. Forest Service, Region 6, 2 pp.

Table 2.--Comparison of pre- and post-spray hemlock looper larval populations in 1962, March and December 1963 egg counts, and 1963 larval populations on 11 plots in Clatsop County, Oregon.

Plot No. 1/	Larvae in 3-tree sample in 1962		Eggs per sample collected during 1963 surveys		Larvae per 5-tree sample in August 1963
	Pre-spray count	Post-spray count	March	December	
	Number				
1	23	0	3	0	0
5	104	9	39	0	4
6	69	11	0	0	1
6A	93	3	0	0	0
9A 2/	731	213	2	0	167 4/
11	63	3	0	2	4
13	--	--	64	2	34
16	17 3/	0	0	1	1
16A	25	9	0	0	0
18	--	--	17	10	27
20	--	--	3	0	25

1/ Plots 13, 18, and 20 established in 1963.
2/ Ten trees sampled in 1962.
3/ Only 2 trees sampled in 1962.
4/ Only 7 of 10 original trees found in 1963.

DIFFERENCES IN LOOPER LARVAL POPULATIONS BY COLLECTION SITE

An analysis was made to compare larval numbers in the understory with those in the overstory. Overall, larval numbers from understory collections were significantly greater than those from overstory collections (at $p = 0.01$). At 19 of the 24 plots, larval numbers were greater in the understory than the overstory, at one plot the same, and at four plots less (table 1).

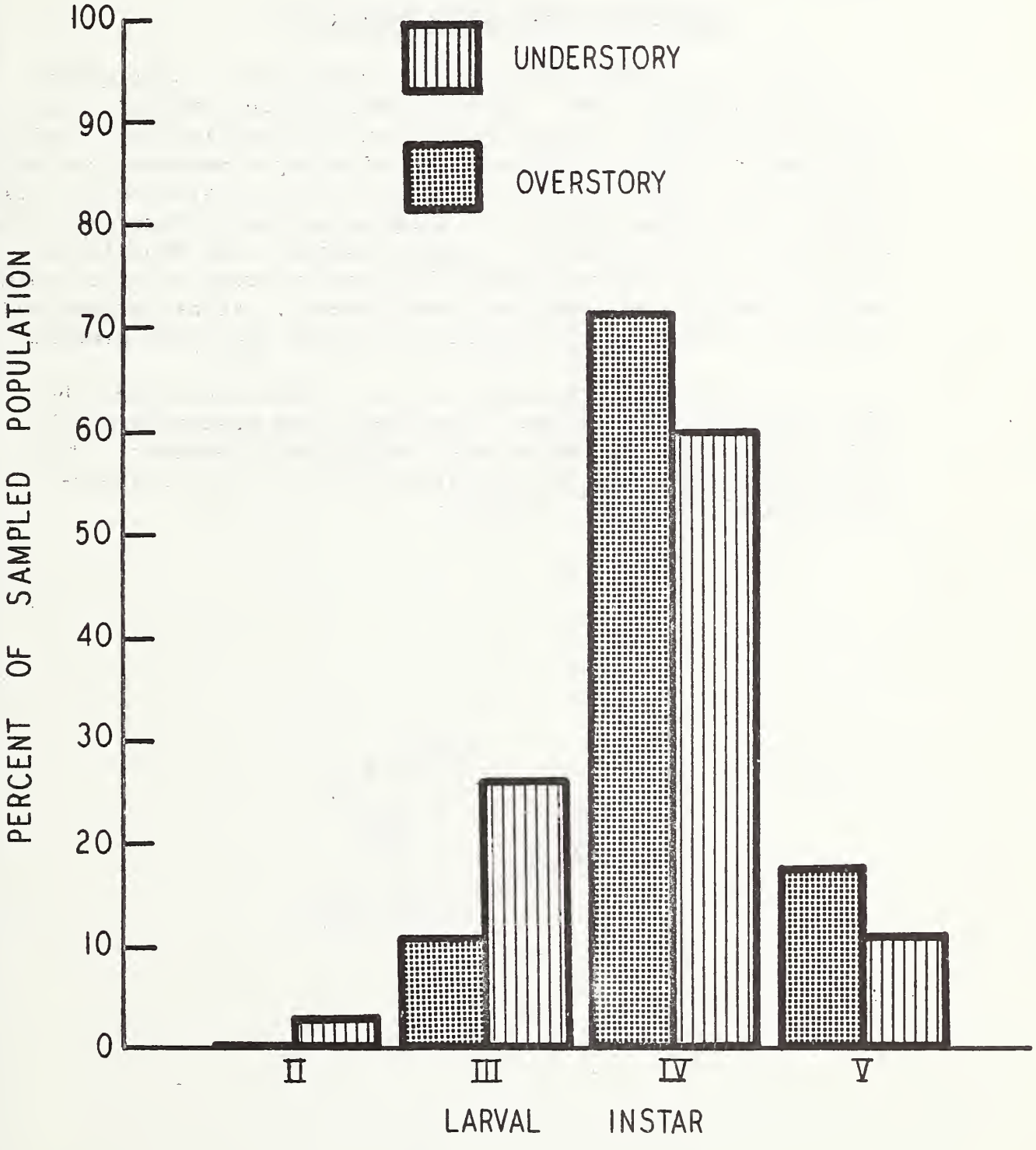
LOOPER LARVAL DEVELOPMENT IN THE UNDERSTORY AND OVERSTORY

Larvae were separated into stage of development by head capsule width measurements. During the week of August 5-9, most larvae were in the third, fourth, and fifth instars. Only one first instar and 28 second instar larvae were recovered from a total of 1,575 larvae. Over 60 percent of the larvae were in the fourth instar (figure 1).

FIGURE - 1

WESTERN HEMLOCK LOOPER LARVAL DEVELOPMENT ON UNDERSTORY AND OVERSTORY FOLIAGE

AUGUST 5 - 9, 1963 CLATSOP CO., OREGON



Larvae from the 24 plots were separated by collection site to determine if development at the two crown levels was appreciably different. Development in the understory was definitely slower than in the overstory (figure 1). More second and third instar larvae were collected in the understory and more fourth and fifth instars in the overstory. This difference can generally be expected because, normally, more moderate temperatures prevail in the understory of old-growth hemlock stands and very little direct insolation occurs.

UNDERSTORY HOST PLANT PREFERENCE

Understory plant species were sampled for looper larval presence in August 1963. Of the seven species sampled, collections were most frequently made on red whortleberry, ovalleaf whortleberry, western hemlock, and vine maple because they were consistently found in the forest understory. Salmonberry, stink currant, and salal plants were sampled on plots where they were abundant. Of the four main species sampled, red whortleberry yielded the most looper larvae followed in order by vine maple, western hemlock, and ovalleaf whortleberry. Stink currant and salal were excellent collecting media when they were present.

In the future, understory larval collections should be made from red whortleberry, vine maple, and western hemlock and stink currant and salal when sufficiently present. Ovalleaf whortleberry may be substituted for one of the above-mentioned species when necessary.